

Comparing the hand grip power and creatine kinase levels of U-17 judo national team athletes before and after a 6-week strength training

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The aim of this study is to compare the hand grip power and creatine kinase levels of male and female U-17 National Team Athletes before and after a 6-week strength training.

Material: 15 female and 15 male U-17 athletes, who previously participated in international competitions, participated in our study. Besides the hand grip power and creatine kinase values, age, height, weight, and BMI (body mass index) values of the athletes were measured before and after the training. As the conclusion of the measurements, the mean age of the female participant athletes was determined as 14,93 years, their mean height was 158,3 cm, and the mean age of the male athletes was 15,73 years, while their mean height was 173,1 cm.

Results: As the conclusion of the measurements, it was determined that there were statistically significant differences between the right hand grip power and left hand grip power parameters of male and female participant athletes measured before and after the 6-week training. Moreover, it was determined that there were statistically significant differences between the pre-test and post-test measurements of creatine kinase values of both male and female athletes ($p > 0,05$).

Conclusions: As the conclusion, it was determined that the 6-week strength trainings applied to U-17 Judo National Team athletes caused significant changes in their hand grip power and creatine kinase values. The significant results obtained from our study are considered to be originated from the duration, scope, frequency, severity, and content of the training.

Keywords: training, judo, creatine kinase, hand grip power.

Introduction

In our age, sports has become an educational tool as well as a lifestyle for human beings. It can be performed in each level of society and conducted in different levels. Many motives have emerged encouraging people to sport. Some of these are popularity, financial gain, opportunity to be recognized in one's country and worldwide, and to become mediatic. Sports is now seen as a professional means of financial gain rather than a recreational activity.

The impact of strength on success in all sports branches is accepted by everyone. In particular, the quality and quantity of strength in the weight sports is gaining more importance. Nowadays, the evaluation of strength and strong athletes is employed in proportion to the strength the athletes produce per body weight as well as by their body structures [1, 2, 3].

Judo, among the weight sports, is one of the branches in which the highest importance attributed to the strength produced per body weight. The body parts also need to have sufficient level of muscle strength for movement skills and techniques applied in sports branches. Since the isometric strength development is particularly based on branch, it is expected to be better in judo players. The general strength development of a judo player is the isometric strength. The isometric strength of hand,

finger, and forearm muscles are measured through a dynamometer.

Since in weight sports, particularly in Judo branch, it is needed to apply techniques by holding the collars and cloth of the opponent, isometric strength is quite important. The higher a Judo player has isometric strength, in other words hand grip power, the higher becomes one's technique capacity, thus, the higher one's probability to win the competition. Even, for this reason, kumi-kata trainings are implemented particular to Judo and directly proportional with hand grip power.

Strength.

The strength, from a biological standpoint, is defined as the ability to move a mass, to overcome a resistance or to influence it with muscle function. Muscle strength is closely related to the environmental factors such as nervous system, endocrine system, age and gender [4]. Without the general strength, the development of other strength units, especially the special strength, will not be at the desired level. A low level of general strength is the most important factor that restricts the entire development of the athlete. The general strength is the strength of all muscles without particular tendency to any sports branch and it is the basis of the entire strength program [5].

The special strength is the strength that is particular to any sport branch [6]. The strength has a different meaning for each other branch. Therefore, comparing the strength

levels of athletes in different sports branches is an invalid approach. The special strength must be developed up to the highest level and combined with other motoric features in a gradual manner towards the end of the preparatory phase for all elite athletes [7].

Pure strength is the highest strength that an athlete can apply without considering one's body weight [6]. Relative strength is the result obtained through dividing the pure strength by the body weight, which is a parameter of the strength measurement. The relative strength is the highest possible strength that an athlete can develop against one's own body weight [8].

Isometric strength; when the muscles remain motionless during muscle contraction and having no change in the neck during contraction is a static force and no movement is observed in the joints.

A comprehensive investigation over the physical and physiological characteristics of athletes will provide great improvements in sports particularly in terms of science of training. In addition, it is necessary to be at high levels in terms of both technical and motoric features. In Judo, particularly because of the techniques of holding the opponent with bare hands, having a high hand grip power becomes an advantage for the athlete. All of these hand grip techniques are called as kumi-kata and it progresses in line with the hand grip power. The stronger the athlete has the hand grip power, the stronger and better one can implement the kumi-kata and get an edge over the opponent.

What is Creatine Kinase?

The basic motoric features of human are the elements determining the strength skill of the body and mixed sports performance degree [9].

Judo is a far eastern sport that requires athletes to have a high level of personal skill, technical-tactical knowledge as well as certain physical and physiological parameters to reach the level of success. Therefore, the main goal of Judo training is to ensure that athletes achieve their highest performance. Today, Judo, which is one of the most common branches in the world, relies on the development of basic motoric properties such as endurance, speed, mobility, coordination, and particularly on general strength and the strength particular to Judo.

Muscle damage is an acute condition that causes fatigue, loss of function, loss of strength and pain in muscles as a result of unconventional and intense exercise [10]. The metabolic damage to the muscle occurs during the submaximal operation, which is conducted up to prolonged exhaustion [10]. When there is muscle damage, the activity of Creatine Kinase (CK) increases, which is the intracellular enzyme in plasma and serum. Creatine kinase, which is an indicator of muscle damage, also increases after exercise [10, 11]. In particular, the direct loading on muscle can cause damage to muscle, and this metabolic change may further aggravate the damage [12]. In previous studies, it was determined that unusual eccentric contractions caused exercise-induced muscle damage [13, 14]. It was revealed that eccentric and concentric contractions lead to muscle damage, but

majority of muscle damages were generated from eccentric exercise based on the muscular structure [12, 15]. The pre-training of the muscle is one of the factors preventing the occurrence of exercise damage. It is observed that the high serum CK levels reached right after the first exercise are decreased in pre-trained athletes. This is interpreted as the exercise adaptation of the muscles and as an indication of the physical fitness level of the athlete [16].

After repeated exercise practices, rapid recovery in the strength, smaller limitation of joint range of motion, decreased muscle edema and pain, and fewer abnormalities in MRI and ultrasound imaging are observed [17]. It was reported that the first severe eccentric exercise will prevent, for a month, the damage possibly arising from further severe eccentric exercises [18]. If the body is engaged in a constant struggle with a careful and progressive approach, adaptations will be observed and the body will become stronger [19]. It is observed that regular strength trainings cause an increase in muscle endurance, muscle mass, and muscle strength in young athletes, while decreasing [20].

The aim of this study is to compare the hand grip power and creatine kinase levels of male and female U-17 National Team Athletes before and after a 6-week strength training.

Material and Methods

Participants.

15 female and 15 male U-17 athletes, who previously participated in international competitions, participated in our study. Besides the hand grip power and creatine kinase values, the age, height, weight, and BMI (body mass index) values of the athletes were measured before and after the training. As the conclusion of the measurements, the mean age of the female participant athletes was determined as 14,93 years, their mean height was 158,3 cm, and the mean age of the male athletes was 15,73 years, while their mean height was 173,1 cm.

Research Design.

The height and weight measurements of the participant athletes were conducted through a tape with 1 cm sensitivity and an electronic scale. Subsequently, the maximum hand grip power measurements of the participant athletes were employed through a hand dynamometer adjusted to the hand size, starting from the dominant hand while the athlete was standing upright and the arm straight making a 10-15 degree angle on the side. Two measurements were employed for each subject and the better one was recorded. Creatine kinase measurements of the participant athletes were analyzed in Selçuk University Medical Faculty Hospital Laboratory. These measurements were repeated in the same way after the 6-week strength training and all measurements were recorded.

The Training Program.

The strength trainings were applied 2 hours a day, 5 days a week, and totally for 6 weeks. For each movement of each athlete, 6 repeated maximals (6 RM) were employed, and the 6 RM was determined as one repetition in two weeks. All athletes conducted joggings, gymnastic

movements, and stretching exercises at sufficient level for warming up. 6 movements were determined for the athletes. The movements in the strength training were comprised of bench press (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets), squat (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets) military press (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets), Barbell Shoulder Press (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets) Barbell curl (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets) and Pushdown (6 repetitions at the 50%, 75%, and 100% of the 6 RM, 3 sets).

Statistical Analysis.

The analysis of the data was conducted through the SPSS 22.0 package program. The results of the measurements were displayed as mean (X) and standard deviation (SD). In order to compare the data taken before and after the training concerning the hand grip power and

creatine kinase, the paired t test was implemented for the dependent groups. The significance level was accepted as $p < 0,05$.

Results

The height and weight figures of the participant athletes and their hand grip power values, which were measured before and after the 28-day training program, are summarized in the following tables.

When Table 1 was examined, the mean age of the males was observed as 15,73 years, and mean height figure was 173,13 cm. The mean age figure of the females was 14,93 years and mean height figure was 158,3 cm.

When Table 2 was examined, it was determined that there were statistically significant differences in the body weight (kg) and body mass index (BMI) parameters of the female Judo players ($p < 0,05$), there was statistically significant difference in the body weight (kg) parameter

Table 1. The Demographical Properties of the Participant Females and Males

Variables	Gender	N	X	SD	min	max
Age	Female	15	14.93	1.22	13	17
	Male	15	15.73	0.96	14	17
Height	Female	15	158.3	5.42	151	167
	Male	15	173.13	7.83	154	184

Table 2. The Pre-test and Post-test Results of the Participant Females and Males Concerning the Weight and BMI (Body Mass Index)

Variables	Gender	Measurements	N	X	SD	t	P
Weight	Female	Pre-test	15	53.33	7.3	-5.55	0.00
		Post-test	15	56.6	7.16		
	Male	Pre-test	15	66.2	8.09	-3.05	0.009
		Post-test	15	67	7.71		
BMI (Pre-Post)	Female	Pre-test	15	21.81	3.92	-4.95	0.00
		Post-test	15	22.28	3.86		
	Male	Pre-test	15	22.58	3.62	-2.82	0.14
		Post-test	15	22.83	3.59		

* $p > 0,05$

Table 3. The Hand Grip Power Pre-test and Post-test Results of Participant Females and Males

Variables	Gender	Measurements	N	X	SD	t	p
Hand Grip Power	Males-right hand	Pre-test	15	29.73	2.15	-6.98	0.00
		Post-test		31.66	2.25		
	Males-left hand	Pre-test	15	29.06	2.31	-8.87	0.00
		Post-test		30.46	2.09		
Hand Grip Power	Females-right hand	Pre-test	15	24.86	2.26	-10.64	0.00
		Post-test		26.6	1.99		
	Females-left hand	Pre-test	15	23.73	1.98	-7.35	0.00
		Post-test		25.20	2.30		

* $p > 0,05$

Table 4. The Creatine Kinase Pre-test and Post-test Results of Participant Females and Males

Variables	Gender	Measurements	N	X	SD	t	p
Creatine Kinase (CK) U/L	Female	Pre-test	15	158	1.07	-5.32	0.00
		Post-test		166	1.12		
	Male	Pre-test	15	176	1.04	-9.41	0.00
		Post-test		185	1.14		

*p>0,05

of the male Judo players, while there was statistically no significant difference in the body mass index (BMI) parameters of the male Judo players.

When Table 3 was examined, it was observed that there were statistically significant differences in the right hand grip power and left hand grip power parameters of females, and right hand grip power and left hand grip power parameters of males (P<0,05).

When Table 4 was examined, it was determined that there were statistically significant differences in the pre-test and post-test creatine kinase parameters of females and males (P<0,05).

Discussion

In this study, it was determined that there were statistically significant differences in hand grip power and creatine kinase values of the participant athletes measured before and after the 6-week strength training.

Considering the previous studies in the literature.

In a study conducted to examine the impact of an 8-week quick power training implemented to the junior wrestlers, [21] determined statistically significant differences concerning the pre-test and post-test values of right hand grip power, and similarly, statistically significant differences were determined concerning the pre-post test figures of left hand grip power.

In studies conducted by [22-25], it was determined that there were statistically significant decreases in the pre-test and post-test values of CK levels. It was concluded that these decreases were because of the adaptation of athletes to exercises [26] reported that there was statistically significant increase in the CK levels in the maximal strength trainings, and. [27] determined that there were statistically significant increases in the CK levels of 17 male beach handball players after competition. [28] determined that there was a high increase in the CK level just after a high-performance bicycle competition.

In a study conducted by [29] on 235 male athletes in the English Olympic team, it was determined that there was a statistically significant increase in the CK level 6 hours after the exercise. Anugweje and [30] concluded that the CK levels of athletes significantly increased after training, additionally, in their study conducted on basketball players, they determined that there were statistically significant increases in the CK and CKMB values after a 2-hour basketball training. Following a ski and bicycle competition, [31] determined that the post-competition CK levels of 16 athletes increased 7 times

higher than those of before the competition.

There are studies in the literature conducted on the impacts of muscle damage on the athletic performance [32-36]. In a study conducted by [33] individuals conducted 100 deep jumps so that muscle damage was created. Following the muscle damage, they detected peak increases at the 48th hour in 5 m and 10 m sprint time values and agility test values. Additionally, they determined significant decreases at the 24th and 48th hours in the isokinetic torque. As the conclusion of this study, it was determined that the muscle damage created after 100 deep jumps influenced the sprint time values negatively.

In a study conducted by [37] study with 15 male football players. They applied the sprint protocol that created football-specific muscle damage to the subjects. Muscle pain, joint range of motion, muscle strength, CK and lactat dehydrogenase enzyme values as indicators of muscle damage; measured physical performance, speed, quickness, power and static and dynamic balance values before the sprint protocol (normal value) and after 24, 48, 72 hours. According to the research findings Muscle pain, CK and lactate values were significantly higher compared to normal values. In addition, the subjects' speed, quickness, strength and balance values were adversely affected by the application of the sprint protocol that was specific to create muscle damage.

In another the study [38] where they performed 45 minutes of eccentric bicycle exercise in untrained male individuals with training long-distance runners, they showed that CK values measured 5 days after the exercise reached the peak level and returned to basal level in 9 days compared to the rest level. On the contrary, they stated that the CK values of the athletes increased twice by one day after the exercise and returned to normal after 2 days.

Although, in the literature, there are cases with occasional decreases and significant differences in the CK levels based on the duration of the training and adaptation, in our study, it is considered that the CK levels increased based on the content and frequency of the training.

Conclusion

As the conclusion, when the pre-test and post-test hand grip power and creatine kinase values of the participant athletes were examined, it was determined that there were statistically significant differences. It is considered that the significant differences obtained in our study are based on the duration, scope, frequency, severity, and content of

the trainings.

Conflicts of Interest

The authors state no conflicts of interest.

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Cite this article as:

Nuri M. Çelik, Mehmet Soyak. Comparing the hand grip power and creatine kinase levels of u-17 judo national team athletes before and after a 6-week strength training. *Pedagogy of physical culture and sports*, 2020;24(4):163-168. <https://doi.org/10.15561/26649837.2020.0402>

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Received: 02.02.2020

Accepted: 09.03.2020; Published: 30.08.2020